# Air Force Office of Scientific Research


## *Taiwan – AFOSR Nanoscience Initiative Status*

***Presented at the USAF/Taiwan Nanoscience Initiative Workshop, Honolulu HI***

***17 February 2005***

***The Basic Research Manager for the Air Force***

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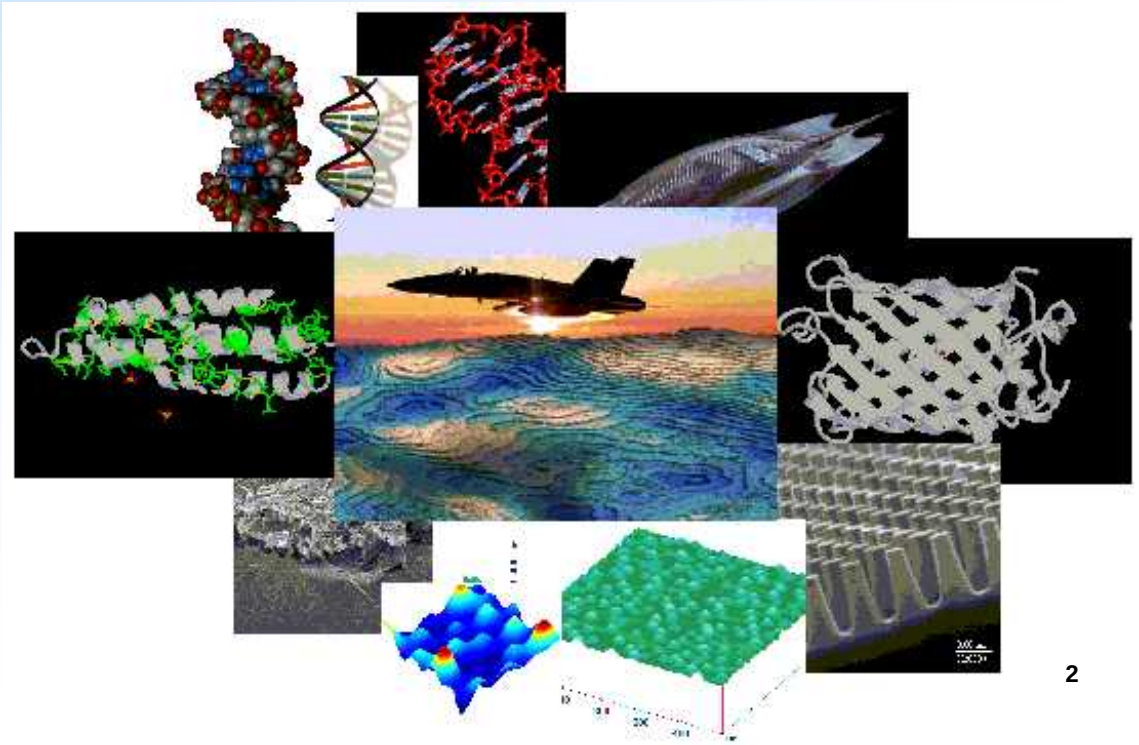
# Agenda

- **Overview**
- Research Funding
- WOS and Conference Support
- Summary



# Taiwan – AFOSR Nanoscience Initiative

## GOAL

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**Establish mutually beneficial scientific interactions between researchers in Taiwan and AFRL scientists**

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- **Foster basic research innovation & interactions between scientists**
- **Enhance future USAF capabilities through support of Air Force fundamental nanoscience research efforts**

# Taiwan/Air Force Program Concept

**AFOSR Requests White Papers *(2 pages)***

**AFRL & AFOSR Reviews White Papers**

**Select / Request Full Proposal**

**Select Proposals and Award Contracts**

**Key Program Elements**

- **Research Funding**
- **Visits and Joint Workshops**
- **Sponsorship of In-Country Conferences**

**Hold Periodic Joint Technical Exchange Meetings**

USAF – TW Joint Workshop, Maui, Feb 2004

# Nanoscience Initiative Chronology

- Oct 01: AFRL Introduction to TECRO
- Feb 02: High Level AFOSR Delegation to Taiwan, incl. CSIST
  - AFOSR Commander, Chief Scientist, Dir of Phys & Electronics
- Apr 02: AFRL-Taiwan Nanoscience Research Opportunities Seminar (Joint Workshop)
- Aug 02: Visit to Researchers & NSC by AFOSR, AOARD
- Sep 02: High Level Delegation Visit to Taiwan
  - Included AFOSR Director, AFRL Chief Technologist
- Aug 03: AOARD Visit to Researchers
- Nov 03: Visit to Universities, CSIST, & NSC by AFOSR, AOARD
- Feb 04: Joint US Air Force/Taiwan Nanoscience Initiative Workshop, Maui HI

# Feb 2005 Nanoscience Conference

- US Air Force/Taiwan Nanoscience Initiative Workshop, 17-18 Feb 2005, in Oahu
  - In conjunction with 2005 Nano Materials for DoD Applications Symposium in Kona on the Big Island, Hawaii
  - Includes AFRL and Taiwan overview and technical presentations
  - Many thanks to Dr. Harold Weinstock (Workshop Organizer) and Capt Joe Tringe (AFRL/AFOSR), Dr Brett Pokines (AOARD), and Dr. Ting-Kuo Lee (Academia Sinica) for coordinating this workshop
- Workshop is an excellent opportunity for US and Taiwan researchers to review work accomplished under proposals funded previously and discuss white papers for this cycle
- Travel funding
  - AFOSR provided funding to some attending Taiwan researchers under the Windows on Science program
  - Taiwan's National Science Council (NSC) provided funding for other Taiwan researchers in attendance

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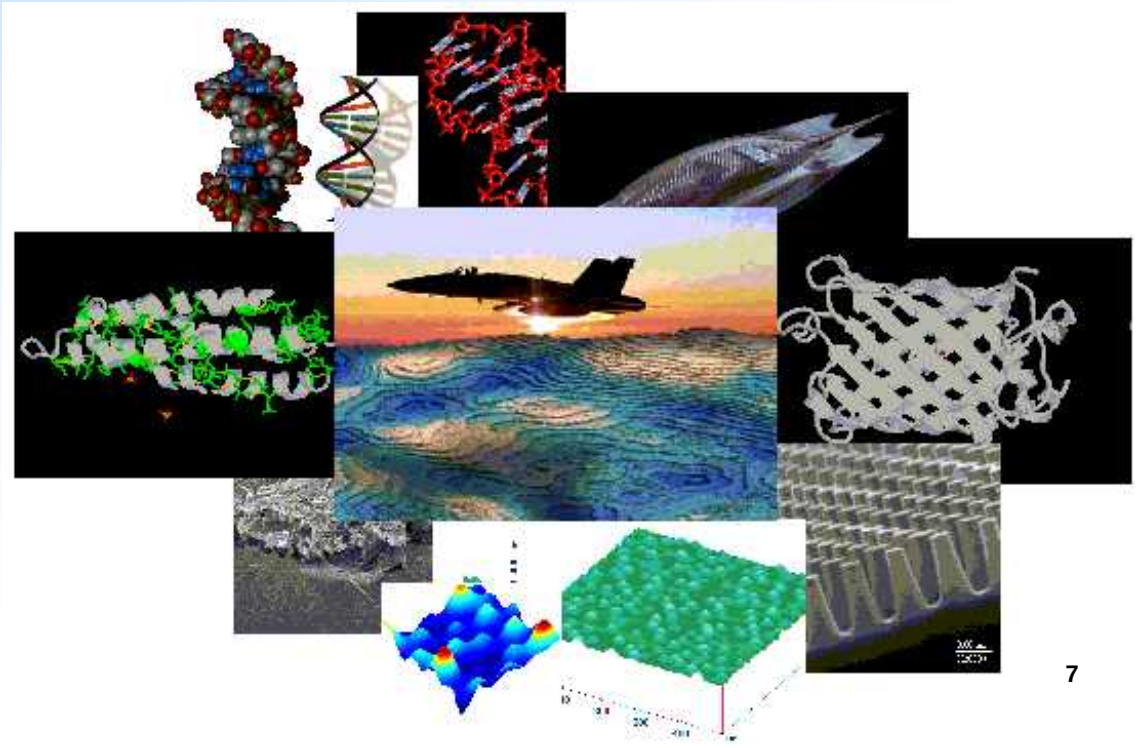


# White Paper / Proposal Schedule

- **Proposed Schedule for FY05 Taiwan – AFOSR Initiative white paper / proposal cycle**
  - **7 Feb 2005 Deadline for white papers from Taiwan researchers → extended to 25 Feb 2005**
  - **17-18 Feb 2005 USAF-Taiwan Workshop**
  - **Mar 2005 AFRL decision to request proposals**
  - **Mar/Apr 2005 Proposals Due**
  - **Apr 2005 Notify PI's of FY05 support decisions**

# White Paper / Proposal Cycle

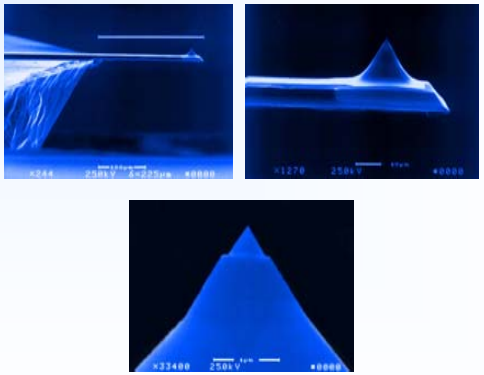
- **Cycle follows established white paper / proposal review process**
  - **Establish connection with AFRL research interests**
  - **Request full proposals**
  - **Review and approve proposals for funding**
  - **AOARD completes contract paperwork**
- **Essential for funding recommendation is complementary match with current AF research interests / niches or future targeted interests**

# AFRL Nanoscience Definition

- **Work at the atomic, molecular and supramolecular levels, in the length scale of approximately 1 – 100 nm range**
- **Understand novel phenomena, properties and functions that occur on nm length scales**
- **Manipulate matter at the nanoscale to control those properties and functions**
- **Achieve macroscale functionality based on properties at the nanoscale**

# Overview of AFRL NST Interest

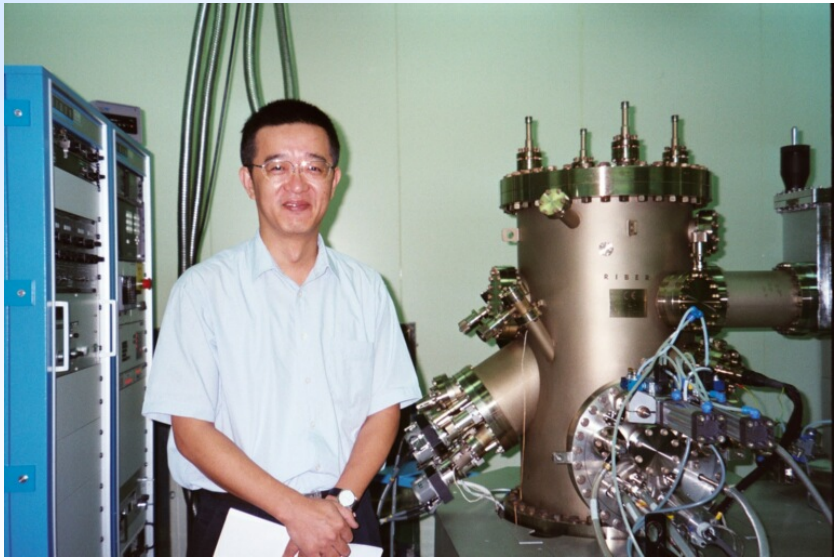
- **Materials Area**
  1. **Tailorable Dielectrics**
  2. **Reconfigurable Optical Response**
  3. **Adaptive Structural Materials**
  4. **Thermal Control Materials**
- **Energy Area**
  5. **Energetics on the Nanoscale**
  6. **Nano-enhanced Power Technologies**
- **Devices Area**
  7. **Quantum Confined Optical Sensors**
  8. **Nanotechnology for RF**
  9. **Nano Signal Processors**
- **Bio-Nano Area**
  10. **Bio Interactions of Nanostructures**
- **Cross-Cutting (foundations)**
  11. **Self-assembly of Nanostructures**
  12. **Nano-Micro-Macro Interfaces**
  13. **Modeling And Simulation**



# Taiwan Projects by Area

- **Materials**
  - **8 projects**
- **Devices**
  - **10 projects**
- **Bio-Nano**
  - **1 project**
- **Energy**
  - **2 projects**
- **Self-Assembly (foundation)**
  - **2 projects**
- **Modeling and Simulation (foundation)**
  - **1 project**

**24 Projects Total to date**



**Dr H-H Cheng, NTU**

# Taiwan Projects in Materials (1)

- **034017, *Investigation on Mechanical Properties of Nano-scale Thin Film*, Yeau-Ren Jeng, National Chung Cheng University**
- **034021, *Diamond-Like Carbon (DLC) Nanocomposite Film Depositions and Characterizations*, Franklin Chau-Nan Hong, National Cheng Kung University**
- **034040, *Growth and Characterization of Nanorods*, Jih-Jen Wu, National Cheng Kung University**
- **034054, *The Relationship of Microscopic Material Characteristics & Physical Behavior of Quantum Dots*, Shan Torng, Chung-Shan Institute of Science & Technology**

# Taiwan Projects in Materials (2)

- **044026, *InGaN/GaN Quantum Dots --- Growth, Nano-structure Material Analysis, and Optical Characterization*, Chih-Chung Yang, National Taiwan University**
- **044073, *Study of Laser Ablation for Generating Nano-Particles*, Jehnming Lin, National Chen Kung University**
- **044074, *Dispersion and Reinforcement of Nanotubes in High Temperature Polymers for Ultrahigh Strength and Thermally Conductive Nanocomposites*, Arnold Chang-Mou Yang, National Tsing Hua University**
- **04xxxx, *Synthesis and Study of Water-soluble Two-photon Absorptive Fullerene Compounds*, Dr. Long Y. Chiang, National Taiwan University**

# Taiwan Projects in Devices (1)

- **024004, *THz Laser based On Ge/Si Heterostructures*, Hung Hsiang Cheng, National Taiwan University**
- **024046, *Polymer Based Field-Effect Transistors*, Ten-Chin Wen, National Cheng Kung University**
- **024052, *Blue Laser Gain Characteristics of InGaN Quantum Dots Embedded in InGaN Quantum Well Structures*, Chih-Chung Yang, National Taiwan University**
- **034019, *Integrated Field Emission Devices Based On Carbon Nanotubes and Related Nanostructures*, Li-Chyong Chen, National Taiwan University**
- **034020, *Study on Wide-Gap Gallium-Nitride Based Films and Their Quantum-dots Devices*, Huey-Liang Hwang, National Tsing Hua University**

# Taiwan Projects in Devices (2)

- 044020, THz laser based on Si, Hung Hsiang Cheng, National Taiwan University
- 044025, Novel Organic Field Effect Transistors via Nano-Modification, Ten-Chin Wen, National Cheng Kung University
- 044070, GaN/AlGaN Terahertz Quantum Cascade Laser, Shing-Chung Wang, National Chiao Tung University
- 044071, Study on Wide-gap Gallium-nitride Films and Their Quantum dots Devices, Huey-Liang Hwang, National Tsing Hua University
- 044072, Ge/SiGe Quantum Dot Detectors and Light Sources at Terahertz Frequencies, Cheewee Liu, National Taiwan University

# Taiwan Projects in Bio-Nano & Energy

- **Bio-Nano**
  - **044008, *High resolution real time phase contrast radiology study of hydrodynamic in micrometer scale*, Maw-Kuen Wu, Academia Sinica**
- **Energy**
  - **044023, *High Efficiency Photovoltaic Devices Fabricated from Self-Assemble Block Insulating-Conducting Copolymer Containing Semiconducting Nanoparticles*, Wei-Fang Su, National Taiwan University**
  - **024048, *High Efficiency Photovoltaic Devices Fabricated from Self-Assemble Block Insulating-Conducting Copolymer Containing Semiconducting Nanoparticles*, Wei-Fang Su, National Taiwan University**

# Taiwan Projects in Foundational Areas

- **Self-Assembly (foundation)**
  - **034018, *Self-Assembly of Block Copolymer/Quantum Dot Nanocomposites for Optical Application*, Kung-Hwa Wei, National Chiao Tung University**
  - **044069, *3D Photonic Crystals Build Up By Self-Organization Of Nanospheres*, Yu-Wen Chen, National Central University**
- **Modeling and Simulation (foundation)**
  - **034039, *Fundamental study on quantum nanojets– structures, dynamics and energetic*, Huei-huang Chiu, National Cheng Kung University**

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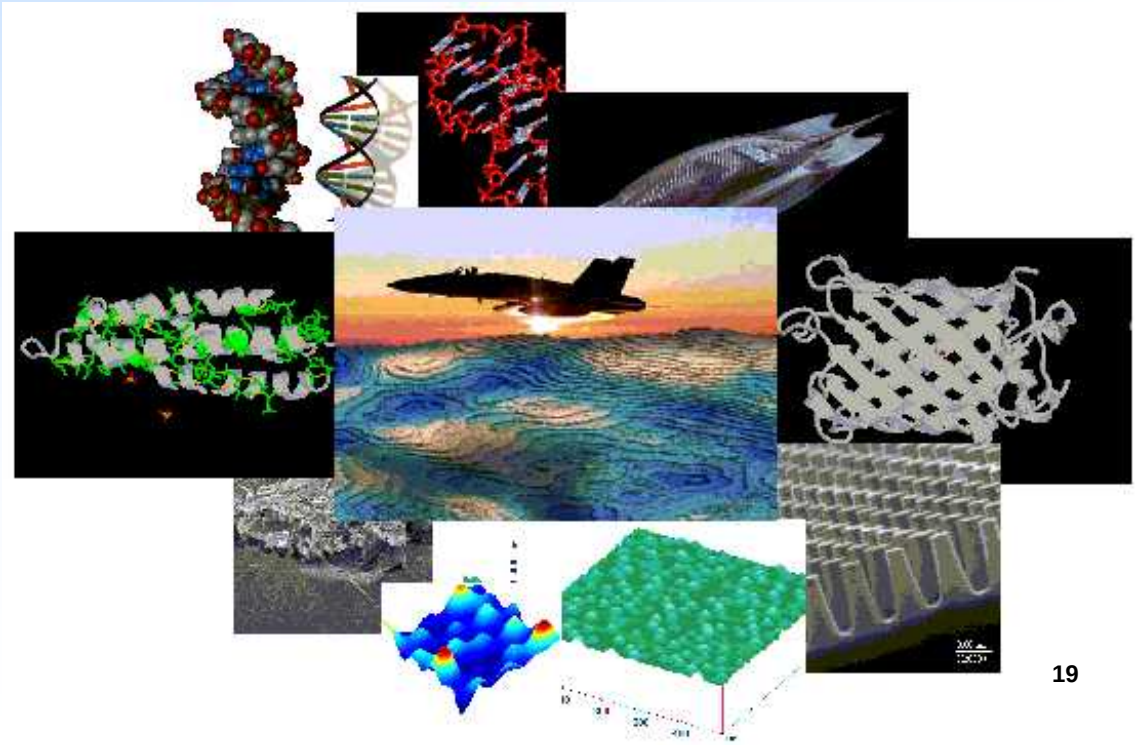

# Windows on Science Activity

- AFRL/SNHC, 12/10/2003 (AOARD Number 042025)
  - Hung Hsiang Cheng, NTU, THz Laser based On Ge/Si Heterostructures
- AFRL/VSSV, 1/3/2004 (AOARD Number 042015)
  - Wei-Fang Su, NTU, High Efficiency Photovoltaic Devices
- 2004 USAF / Taiwan Nanoscience Initiative Workshop, 19-20 Feb 2004 (14 researchers)
- AFOSR/NL, 3/1/2004 (AOARD Number 042016)
  - Ten-Chin Wen, NCKU, Polymer Based Field-Effect Transistors
- AFRL/VSBXT, 10/18/2004 (AOARD Number 052006)
  - Li-Chyong Chen, NTU, Field emission devices based on carbon nanotubes
- 2005 USAF / Taiwan Nanoscience Initiative Workshop, 17-18 Feb 2005 (20 researchers (proposed))

# Conference Support Program

- APAM 2002 International Conference on Collaboration and Networking
  - Location: National Tsing Hua University, Hsin-chu, Taiwan
  - Date: 12/9/2002 (AOARD #021034)
  - Organizer: Huey-Liang Hwang, National Tsing Hua University
- The 2nd East Asia Symposium on Superconductive Electronics (EASSE2003)
  - Location: Taipei, Taiwan
  - Date: 11/16/2003 (AOARD #031053)
  - Organizer: Herng-Er Horng, National Taiwan Normal University
- 1st International Conference on One-Dimensional Nanomaterials
  - Location: Center for Condensed Matter Sciences in National Taiwan University, Taipei, Taiwan
  - Date: 1/10/2005 (AOARD #051013)
  - Organizer: Li-Chyong Chen, National Taiwan University

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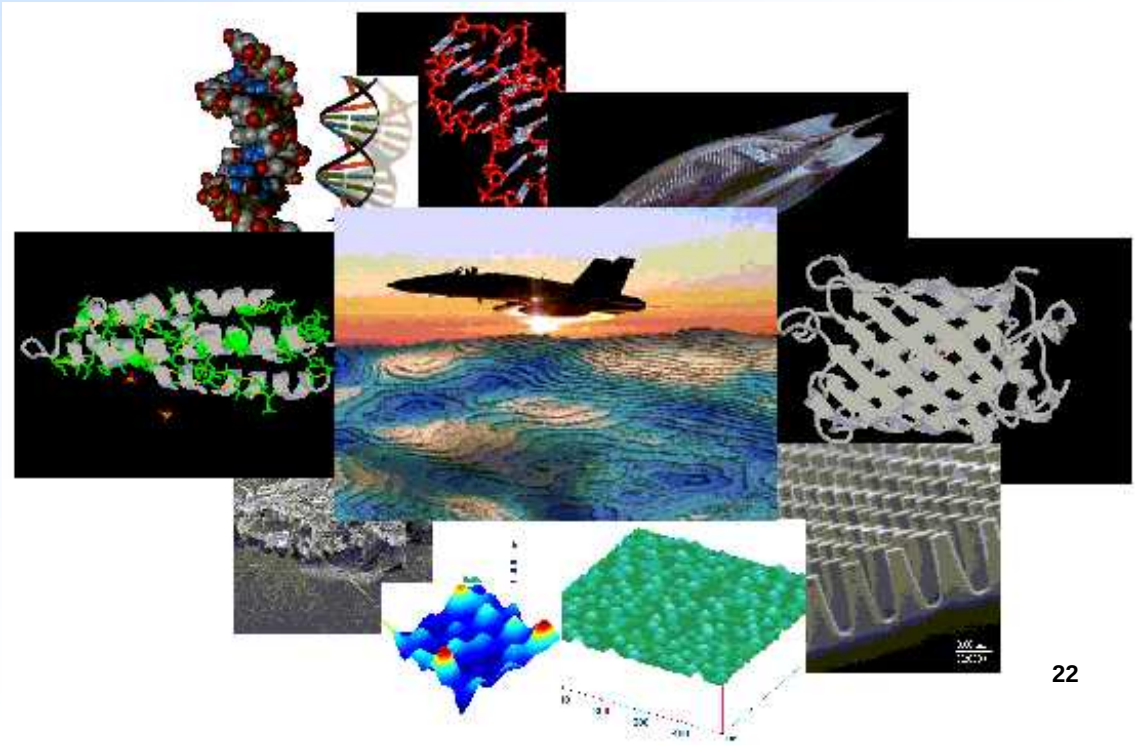
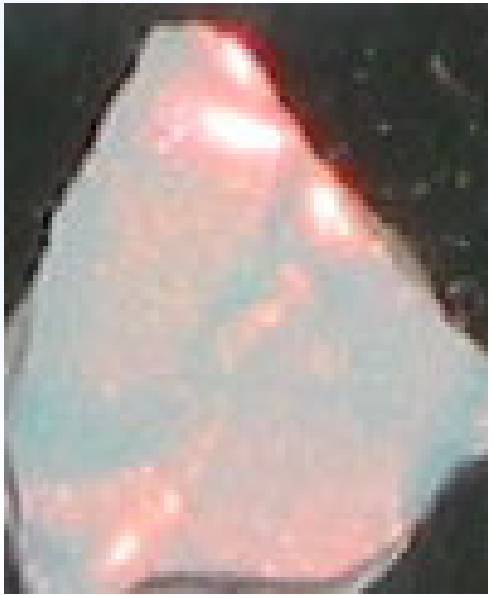


# Nanoscience Initiative Summary

- More than 70 white papers received over life of the program
  - Plus 17 received so far in current white paper cycle
- 24 projects total completed / funded / approved
- 19 visits by Taiwanese researchers to AFRL scientists
  - Plus ~20 visits for current workshop
- 5 visits by AFOSR to Taiwan
- 2 joint workshops



From Prof. W.F. Su, NTU

# Taiwan Initiative Points of Contact

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- **Capt Joseph Tringe, AFOSR/NE – Assistant Program Manager, Taiwan – AFOSR Nanoscience Initiative**
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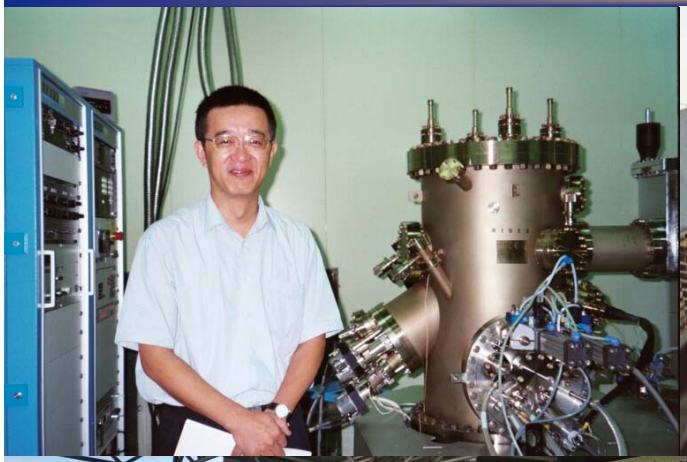
- **Dr Brett Pokines, AFOSR/AOARD – International Program Support – brett.pokines@onrasia.navy.mil**

# Visits Collage

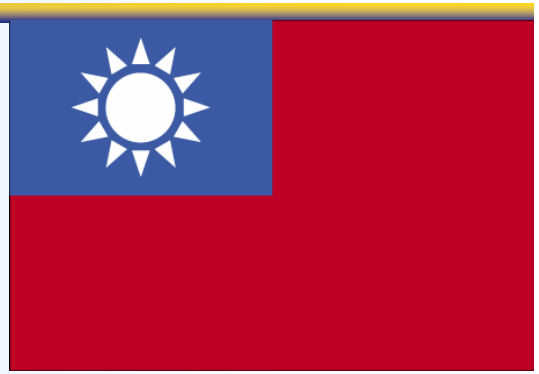





# Closing Thoughts

**WIN**

**WIN**



- **Nanoscience & Nanotechnology R&D is a Major Contributor to Revolutionary System Capabilities**
- **As the Air Force Transforms, Science and Technology Role Increasingly Important**
- **Globalization of R&D is Key**

- **Nano Science and Technology R&D is a National Priority for Taiwan**
- **Create New Products for Traditional Industry, New Bio-tech Industry**
- **Overcome Barriers and Difficulties for Information Technology Industry**

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**Furthers the Scientific Goals of Taiwan and the United States**

# Taiwan - AFOSR Nanoscience Initiative